URBAN Waterways

Permeable Pavements, Green Roofs, and Cisterns

Stormwater Treatment Practices for Low-Impact Development

Stormwater runoff continues to be a concern in communities large and small across North Carolina and the United States. State regulations targeting pollutants such as nitrogen, phosphorus, and total suspended solids have been in place since the 1990s. In 2003, federally mandated stormwater programs were established in more than 100 municipalities in North Carolina. These communities must reduce flooding and improve the water quality of runoff from new residential and commercial developments by using stormwater treatment practices.

In 1999, North Carolina State University Cooperative Extension published its first Urban Waterways fact sheet, an *Overview of Structural Stormwater Best Management Practices*. It described several stormwater practices, including wet ponds, stormwater wetlands, bioretention areas, sand filters, level spreader-riparian buffer systems, and grassy swales. Since then, additional structural practices have become commonplace throughout North Carolina, including the use of *permeable pavements, green roofs,* and water harvesting systems or *cisterns*. This new fact sheet in the Urban Waterways series describes these three stormwater practices and supplements the original overview.

These practices are incorporated within low-impact development (LID). LID uses site planning and engineering to reduce or prevent the adverse impacts of stormwater runoff from both residential and commercial developments. LID relies on both structural and nonstructural practices to conserve the site's natural or *predeveloped hydrologic response* to rainfall – the way rainfall is distributed among runoff, infiltration, and evapotranspiration.

Examples of nonstructural practices include minimizing site disturbance, preserving important site features, reducing and disconnecting *impervious cover* (sufaces that do not allow water to filter through them, such as asphalt and concrete), flattening slopes, utilizing native vegetation, minimizing grass lawns, and maintaining natural drainage features. Structural best management practices (BMPs), such as bioretention (see AGW-588-05 for more information), permeable pavements, green roofs, and cisterns, are used in LID to provide further runoff control and treatment close to the runoff's source.

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